

REMARKS

Claims 1-20 are pending in this application. Claim 1 is the sole independent claim. Claims 2-4, 6-8, 10, 12 and 17 have been amended to recite "The" in place of "A" for purposes of clarification and not to limit their scope. Claim 3 has been amended to recite "exchangeable inorganic ions" in place of "the exchangeable inorganic ions" for purposes of clarification and not to limit its scope. Claim 6 has been amended to recite "a conductive substrate" in place of "the conductive substrate" for purposes of clarification and not to limit its scope. Claims 13-16 have been amended to recite "the" for purposes of clarification and not to limit their scope. The amendments to the claims do not introduce any new matter.

The objection to Claims 2-4, 6-8, 10, 12 and 17 and rejection of Claims 3, 6-8, 12, 13, 15 and 17- under 35 USC §112, second paragraph have been overcome by the above amendments to the claims.

Claim 1 stands rejected under 35 U.S.C. §102(b) as being anticipated by "The Novel Polymer Electrolyte Nanocomposite Composed of Poly(ethylene oxide), Lithium Triflate and Mineral Clay" by Chen et al. (hereinafter "Chen"). Claims 2 and 3 stand rejected under 35 U.S.C. §102(b) as being anticipated or, in the alternative, as being obvious over Chen. Chen does not anticipate and does not render obvious claims 1, 2 and 3.

Claims 1-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over International Publication No. WO 03/054894 to Nelles et al. (hereinafter "Nelles"), in view of Chen et al. The cited references do not render obvious claims 1-20.

As is clear from the disclosure of the present application, especially from claims 1 and 5, important aspects of the present invention reside in the electrolyte comprising:

(i) a layered clay mineral and/or an organically modified layered clay mineral; and

(ii) an ionic liquid.

This electrolyte is useful, as an electrolyte layer, for a photovoltaic device in which the electrolyte layer is located between a photoelectrode and a counter electrode.

As disclosed on page 14, lines 5 - 26 of the specification, the "ionic liquid" (e.g., quaternary ammonium salts, imidazolium salts, pyridium salts, pyrrolidinium salts, piperidinium salts) is known in the art and, as shown by the term "liquid", exists in the form of a liquid under an ambient condition (i.e., a room temperature) and, therefore, when used as an electrolyte, the use of a solvent is not necessary, unlike the other conventional electrolytes known in the art.

This is completely absent in the cited references.

Chen discloses a polymer electrolyte nanocomposite composed of poly(ethylene oxide), lithium triflate (LiTF) (LiCF_3SO_2) and mineral clay. However, Chen does not disclose a photovoltaic device at all. The polymer electrolyte cannot be used for the photovoltaic device. This is common sense to those skilled in the art. It is important to note that the disclosure of Chen is not "for a photovoltaic device", but --for a lithium battery--. Sometimes a "Dye Sensitized Solar Cell" is abbreviated as "DSC", but this is completely different from the "(DSC)" (i.e., Differential Scanning Calorimetry) mentioned in lines 3 - 4 of the Abstract of Chen(see page 9763).

In addition, please be advised that the lithium triflate has a melting point of greater than 300°C^{*1}, and therefore, this is not an ionic liquid at room temperature, unlike the present invention.

^{*1} See the previously filed Exhibit 1 (i.e., SAFETY DATA SHEET for Lithium Trifluoromethane sulfonate (i.e., Lithium triflate) (SIGMA-ALDRICH) (see page 3 of 5).

Nelles discloses a polymer gel electrolyte. It is asserted in the Office Action that Nelles discloses an electrolyte for a photovoltaic cell comprising an ionic liquid (see page 8, lines 22 - 31). However, this is not true, because page 8, lines 22 - 31 disclose the use of LiI dissolved in THF and bistrifluoromethane sulfonimide lithium ($\text{Li}((\text{CF}_3\text{SO}_2)_2\text{N})$) is

added to the mixture. These compounds have higher melting points (i.e., 446°C^{*2} and 234 - 238°C^{*3}) and, therefore, are not ionic liquids.

^{*2}See the previously filed Exhibit 2 (i.e., SAFETY DATA SHEET for Lithium iodide (SIGMA-ALDRICH) (see page 2 of 5).

^{*3}See the previously filed Exhibit 3 (i.e., SAFETY DATA SHEET for Bis(trifluoromethane)sulfonimide lithium salt (SIGMA-ALDRICH) (see page 3 of 5).

Regarding the definition of "ionic liquid", in addition to Exhibits 1 - 3 previously filed, attached to this response are the followings Exhibits 4 – 7.

(1) Exhibit 4: U.S. 7,208,605 B2 filed Apr. 4, 2003 (see col. 1, lines 12 - 21).

Exhibit 4 discloses that room temperature ionic liquids consisting of ions, unlike conventional molten salts, often melt below 100°C and can act as solvents.

(2) Exhibit 5: W02005/096392A2 (FCT/JP2005/006716) (please see especially page 14, line 9, which refers to the following Exhibit 6.

(3) Exhibit 6: "Ionic Liquid" in Japanese, published February 1, 2003 edited by Ono Hiroyuki (CMC Publisher) (please see especially page 173, line 3 from the bottom to page 174, line 12) which states:

The ionic liquids have the following general features, in addition to the above-mentioned low melting points (e.g., 78°C, 15°C, -16°C)

(1) New solvents consisting of ions

(2) Liquids having no vapor pressure

(3) High heat resistance and wide liquid range

....

(5) Chemically stable

(6) High ionic conductivity

...

(4) Exhibit 7: US2004/0214092A1 (especially see [0026] on page 3)

Exhibit 7 discloses that lithium salts (e.g., LiPF_6 , LiBF_4 , LiClO_4 , $\text{CF}_3\text{SO}_3\text{Li}$, LiAsF_6) acts as a source for supplying lithium ions in the battery.

The above additional Exhibits 4 - 7 clearly establish the fact that the "ionic liquids" are well-known in the art as those in the form of a liquid at an ambient temperature and can act as a solvent without using other solvents. In addition, while claim analysis begins with the words of the claims, claims do not stand alone, and must be interpreted in the context of the entire application, including the specification. (please see *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).) Terms in a patent claim can be defined only in a way that comports with the application as a whole. (please see *Markman v. Westview Instruments, Inc.*, 116 S. Ct. 1384, 1395 (1996).)

Concerning obviousness, *Graham V. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) outlines the approach that must be taken when determining whether an invention is obvious. In *Graham*, the Court stated that a patent may not be obtained if the subject matter would have been obvious at the time the invention was made to a person having ordinary skill in the art, but emphasized that nonobviousness must be determined in the light of inquiry, not quality. Approached in this light, §103 permits, when followed realistically, a more practical test of patentability. In accordance with *Graham*, three inquiries must be made in determining whether an invention is obvious:

- (1) The scope and content of the prior art are to be determined.
- (2) The difference between the prior art and the claims at issue are to be ascertained.
- (3) The level of ordinary skill in the pertinent art resolved.

(4) Evaluating evidence of secondary considerations, such as commercial success, long felt but unsolved needs and failure of others, etc. Also see *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007).

Against this background, the obviousness or nonobviousness of the subject matter is determined. Secondary considerations, such as unexpected results, commercial success, long felt but unsolved needs, failure of others, etc., can be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In conjunction with interpreting 35 U.S.C. §103 under Graham, the initial burden is on the Patent Office to provide some suggestion of the desirability of doing what the inventor did, i.e. the Patent Office must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the Patent Office must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference.
2. There must be a reasonable expectation of success.
3. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

The mere fact that the cited art may be modified in the manner suggested in the Office Action does not make the modification obvious, unless the cited art suggest the desirability of the modification or adequate rationale exists to do so. No such suggestion appears in the cited art in this matter nor has the requisite rationale been adequately articulated. . The Examiner's attention is kindly directed to *KSR Int'l Co. v. Teleflex, Inc.*, *supra*; *In re Lee* 61 USPQ2d 1430 (Fed. Cir. 2002), *In re Dembiczak et al.* 50 USPQ2d.

1614 (Fed. Cir. 1999), *In re Gordon*, 221 USPQ 1125 (Fed. Cir. 1984), *In re Laskowski*, 10 USPQ2d. 1397 (Fed. Cir. 1989) and *In re Fritch*, 23, USPQ2d. 1780 (Fed. Cir. 1992).

Also, the cited art lacks the necessary direction or incentive to those of ordinary skill in the art to render a rejection under 35 USC 103 sustainable. The cited art fails to provide the degree of predictability of success of achieving the properties attainable by the present invention as discussed above needed to sustain a rejection under 35 USC 103. See *KSR Int'l Co. v. Teleflex, Inc.*, supra; *Diversitech Corp. v. Century Steps, Inc.* 7 USPQ2d 1315 (Fed. Cir. 1988), *In re Mercier*, 187 USPQ 774 (CCPA 1975) and *In re Naylor*, 152 USPQ 106 (CCPA 1966).

Moreover, the properties of the subject matter and improvements and advantages which are inherent in the claimed subject matter and disclosed in the specification are to be considered when evaluating the question of obviousness under 35 USC 103. See *KSR Int'l Co. v. Teleflex, Inc.*, supra; *Gillette Co. v. S.C. Johnson & Son, Inc.*, 16 USPQ2d. 1923 (Fed. Cir. 1990), *In re Antonie*, 195, USPQ 6 (CCPA 1977), *In re Estes*, 164 USPQ 519 (CCPA 1970), and *In re Papesch*, 137 USPQ 43 (CCPA 1963).

No property can be ignored in determining patentability and comparing the claimed invention to the cited art. Along these lines, see *In re Papesch*, supra, *In re Burt et al*, 148 USPQ 548 (CCPA 1966), *In re Ward*, 141 USPQ 227 (CCPA 1964), and *In re Cescon*, 177 USPQ 264 (CCPA 1973). In view of the above, consideration and allowance are respectfully solicited.

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In the event the Examiner believes another interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees due with this paper to Deposit Account No. 22-0185, under Order No. 21713-00032-US1 from which the undersigned is authorized to draw.

Dated: December 21, 2010

Respectfully submitted,

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